DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the multilayer-interconnection plate used for wiring to the moving part of various electronic equipment, such as a computer and communication equipment, a cable, the composite part that gave the connector function, the circuit module for LSI mounting, etc., especially a multilayer flexible printed wiring board.
[0002]
[Description of the Prior Art] A flexible printed wiring board is what gave metal wiring on the turnable thin base film, is useful to saving of a mounting tooth space, or improvement in dependability, and is widely used for a computer related equipment, an audio product, communication equipment, etc. In connection with thin-shape[the miniaturization of electronic equipment in recent years, lightweight-izing, and]-izing, and densification, the demand of multilayering is increasing to the flexible printed wiring board as well as a rigid printed board. Since the front flesh side, of course, had how many layer thing printed circuit also inside, multilayering of a printed wired board enabled compaction of the distance between components of an electronic circuitry, and large deletion of the number of components, and a connection part according to concomitant use with integrated circuits, such as IC, LSI, and a VLSI.
[0003] Although the multilayer flexible printed wiring board is carried out by the various manufacture approaches from the former, the three-layer flexible printed wiring board which has three layers of metaled conductive layers is mentioned as an example, and an example of a production process is shown in drawing 3 .
[0004] After forming a hole since the circuit pattern 33 which serves as a inner layer after a laminating in other layers of the double-sided copper-clad substrate which uses insulating layers, such as polyimide, as a base material 32 for copper foil 31 is formed by the photo etching method etc. and it flows through a inner layer and an outer layer as first shown in drawing 3 (a), non-electrolytic copper plating is performed for the front face of polyimide resin after activation, and, subsequently an electrolytic copper plating line forms the flow hole 34. And as shown in drawing 3 (b), the laminating of epoxy or the acrylic resin is carried out through the prepreg 37 which consists of glass tissue which sank in, with the heat press 38, under heating, it pressurizes and the insulating-layer 36 side of the one side copper-clad substrate 35 which uses as a base material insulating layers formed in one side of a double-sided copper-clad substrate, such as a circuit pattern and polyimide, is hardened, as shown in drawing 3 (c). Next, as shown in drawing 3 R> 3 (d), the through hole 39 which forms a flow with a front flesh-side conductor layer and an inner conductor layer is formed, non-electrolytic copper plating and electrolytic copper plating are performed after activation, and as further shown in drawing 3 (e), circuit pattern formation is carried out to the copper foil 31 of a front flesh side by the photo etching method.
[0005]
[Problem(s) to be Solved by the Invention] However, by such approach, since the prepreg used at the time of a laminating is using epoxy or an acrylic ingredient, a problem is produced in thermal resistance and dimensional stability. Moreover, since the thickness of the copper foil whose copper-clad substrates which use insulating layers, such as polyimide, as a base material are 35-50 micrometers of insulating layer thickness and a conductor is 18-35 micrometers, if a laminating is

carried out using this copper-clad substrate, the substrate total thickness after a laminating will become thick, and the flexibility which is the description of about [being contrary to thin shape-ization] or a flexible printed wiring board may fall. Moreover, since the flow with a front flesh-side conductor layer and an inner conductor layer is formed with the through hole, it becomes easy to disconnect the wall section by the stress concentration to the through hole section generated at the time of crookedness. While a front flesh side and the diameter of a land of a inner layer furthermore benefit laminating alignment precision reservation large, wiring of the conductor of a front flesh side and a inner layer is restricted and high density wiring becomes difficult, a limit becomes large also in respect of a design.

[0006] It is made that the above-mentioned technical problem should be solved, and excels in thermal resistance and dimensional stability, and it is more thin, and is more flexible, physical stress is eased, and this invention aims at offering the manufacture approach of the multilayer flexible printed wiring board which enabled high density wiring further.

[0007]

[Means for Solving the Problem] After this invention forms a circuit pattern in the copper foil on the copper-clad substrate which used polyimide resin as the base material After applying a polyimide precursor all over the substrate in which the circuit pattern was formed, carrying out hardening processing and forming a polyimide layer After forming the conductive layer which consists of copper by nonelectrolytic plating and electroplating on the polyimide layer which carried out surface treatment after the polyimide layer carried out surface treatment by the oxygen plasma, while forming a circuit pattern in a conductive layer Opening used as a flow hole with other layers is formed in a polyimide layer by etching. It is the approach of forming the flow section in opening with nonelectrolytic plating and electrolytic copper plating, and is the manufacture approach of the flexible patchboard which repeats the count equivalent to the layer of the multilayer-interconnection plate which needs the process after spreading of a polyimide precursor.

[0008] Namely, the process which prepares predetermined opening in the copper-foil face of the (a) aforementioned double-sided copper-clad substrate using the double-sided copper-clad substrate with which this invention used polyimide resin as the base material, (b) The process which removes alternatively only the polyimide resin section exposed from said opening, (c) The process which performs non-electrolytic copper plating and electrolytic copper plating after activation for the purpose for which said polyimide resin section performs the flow between front flesh-side copper foil by the part by which selection removal was carried out, (e) The process which heat-treats the double-sided copper-clad substrate with which the solvent content polyimide system paste was applied to the circuit forming face of the double-sided copper-clad substrate with which formation of said predetermined circuit was made, and the polyimide system paste was applied to it, and promotes hardening of a polyimide system paste, (f) The process which carries out surface treatment of the front face of the polyimide insulator layer formed by carrying out heat-curing processing of the polyimide system paste by oxygen plasma treatment, (g) The process which performs nonelectrolytic plating and electrolytic copper plating, and forms a metallic foil after carrying out activation of said polyimide insulator layer by which surface treatment was carried out, (h) The process which prepares opening in the predetermined section of said metal copper foil, and the process which removes alternatively the polyimide insulator layer exposed from the (i) aforementioned opening, (j) through opening removed alternatively, said polyimide in order to perform a flow with said 1st predetermined circuit section and metal copper foil After carrying out activation, multilayering is made possible according to the process which performs non-electrolytic copper plating and electrolytic copper plating processing, and the process which forms the 2nd predetermined circuit in the metal copper-foil face formed in the (k) aforementioned copper plating, and the above-mentioned technical problem is attained.

[0009]

[Function] By the manufacture approach of this invention, it excels in thermal resistance and dimensional stability, and it is more thin, and is more flexible, physical stress is eased, and the multilayer FPC with the high dependability in which high density wiring is possible can be offered.

[0010]

[Example] Hereafter, the example of this invention is explained based on a drawing. Drawing 1

shows the production process of the three-layer flexible printed wiring board which is a multilayer flexible printed wiring board in this invention.
[0011] As shown in drawing 1 (a), in order to prepare the Bahia hole for flowing through the copper foil used as the electrical circuit of a inner layer, and surface copper foil in one copper foil of the copper laminated circuit board 3 which carried out the laminating of the copper foil 1 to both sides of the base material film 2 of polyimide, a hole 4 is formed in copper foil by etching for the Bahia holes. The hole 5 for the Bahia holes is formed in the base material film 2 by using copper foil as a mask like drawing 1 (b). The alcoholic solution containing alkali-metal hydroxides, such as a potassium hydroxide, can be used for an etching reagent. it is shown in drawing 1 (c) -- as -- a inner layer -- a conductor and a lining -- in order to make it flow through a conductor, after activating the front face of a base material film with a palladium chloride, the 1st tin of chlorination, etc., nonelectrolytic plating is performed, copper is electroplated on the thin film of the copper subsequently obtained with nonelectrolytic plating, and the Bahia hole 6 is completed. On the substrate which formed the predetermined circuit as were shown in drawing 1 (d), and the predetermined circuit pattern 7 was formed by etching on the conductive layer for inner layers and it was shown in drawing 1 (e), after having heated the solvent after applying coating which consists of polyamide acids, such as polyimide system coating from which a polyimide film is obtained by heating, etc., and removing, it heated further, hardening processing was carried out, and the polyimide layer 8 was formed.
[0012] As shown in drawing 1 (f), by the oxygen plasma 9, the front face of a polyimide layer was processed and the adhesion force of the copper to a polyimide layer top was heightened. As shown in drawing 1 (g), after activating the front face of the polyimide layer 7, copper nonelectrolytic plating was performed, and copper foil was formed by electroplating on the thin film of the obtained copper.

[0013] The hole 4 equivalent to the Bahia hole between multilayers was formed in the business shown in drawing 1 (h) by the approach shown on copper foil 1 at drawing 1 (a), and the same approach, as shown in drawing 1 (i), the copper foil which formed the hole obtained at the process of drawing 1 (h) like the approach shown in drawing 1 (b) was used as the mask, and the hole 5 was formed in the polyimide layer 7. Furthermore, as shown in drawing 1 (j), the Bahia hole 6 which forms the flow between multilayers was formed like the approach shown in drawing 1 (c). And as shown in drawing 1 (k), double-sided copper foil was etched and the circuit pattern 10 was formed.
[0014] Without using a glue line like the approach using prepreg according to the above process, it can excel in thermal resistance and dimensional stability, and it depends, and it is thin and multilayer flexible printed wiring board FPC in which more flexible high density wiring is possible can be manufactured.
[0015] Moreover, the multilayer-interconnection substrate of three or more layers can be manufactured by repeating the same process as drawing 1 (d) - drawing 1 (j) after the process shown in drawing 1 (j). An example of a multilayer-interconnection substrate which has the conductive layer of six layers in all is shown in drawing 2 R> 2.
[0016] Conductive layer 22a is formed on the polyimide film 22, polyimide layer 23a is prepared on conductive layer 22a, and conductive layer 22b, polyimide layer 23b, conductive layer 22c, polyimide layer 23c, 22d [of conductive layers], and polyimide 23d is further prepared on the polyimide layer.
[0017] And the circuit pattern 24 is formed in both sides of a multilayer substrate, and the Bahia hole 25 which makes it flow through between each conductive layer is formed.
[0018] the conductor which becomes one side of 35 micrometer copper foil laminating polyimide film (the product made from Nippon Steel Chemistry, a trade name: ESP NEKKUSU double-sided plate) of polyimide insulation layer thickness which carried out the laminating of the copper foil with a thickness of 18 micrometers to example 1 both sides with a inner layer -- the conductor used as a circuit and a surface -- in order to prepare the Bahia hole for flowing through a circuit, the hole with a diameter [for the Bahia holes] of 300 micrometers was formed in copper foil by the photo etching method. Etching makes an etching agent 42 degrees of ferric chloride water solutions of the concentration of Be, and is the temperature of 40 degrees C, and spray ** 1.0 kgf/cm2. Spray etching performed.

[0019] Subsequently, in the temperature of 70 degrees C, etching removal of the polyimide resin layer of the Bahia hall formation part was alternatively carried out under the exposure of a supersonic wave by making into an etching agent the alcoholic solution which mixed the ethanol and water of a 1-N potassium hydroxide at a rate of 8:2, having used as the mask the copper foil in which the hole was formed.
[0020] Next, the conductive layer was formed in the interior of the Bahia hole. First, palladium-chloride (PdCl2):0.2 g/l, 1st tin [of chlorination] (SnCl2 and 2H2 O):20 g/l, hydrochloric-acid (HCl, 35%): -- solution temperature [which set the whole to 1000ml for 200 ml/l with pure water] whenever: -- in 40-degree C activation liquid It is immersed for 2 minutes and the front face of polyimide resin is activated. Immersion time amount : Copper-sulfate (CuSO4 and 5H2 O):5 g/l, Rosell salt (KNaC four H4O6): The liquid which set the whole to 1000ml with 25 g/l, formalin (HCHO):10 ml/l, sodium-hydroxide (NaOH):7 g/l, and pure water was used, and nonelectrolytic plating was performed at :20 degree C whenever [solution temperature]. Then, whenever [copper-sulfate (CuSO4 and 5H2 O):240 g/l, sulfuric-acid (H2 SO4, specific gravity 1.83):50g/l., cathode-current-density:3 A/dm2, cathode:anode plate =1:1, anode plate:electrolytic copper, bath voltage:3V, and solution temperature]: Copper was electroplated on 30-degree C conditions.
[0021] Subsequently, they are the temperature of 40 degrees C, and 1.0kg/cm2 of spray **, using 42 degrees of ferric chloride water solutions of Be as an etching reagent. By spray etching After forming a predetermined circuit in the copper foil used as a inner layer, to the side in which the conductor of a inner layer was formed The polyimide precursor (the trade name made from Nippon Steel Chemistry, polyimide paste SPI-200N) was applied to the uniform thickness of 24 micrometers with screen printing using the version of 150 meshes, and the insulating layer was formed. Then, at the far-infrared furnace of a conveyor type, it heats for 10 minutes and 130 degree C (N-methyl-2-pyrrolidone) of NMP(s) which are a solvent component were evaporated, with 270 degrees C and heating for 2 minutes, the polyimide paste was stiffened completely and the polyimide layer was formed. Surface treatment of the front face of the obtained polyimide layer was carried out by the oxygen plasma. the processing by the oxygen plasma -- dry tech company make -- it carried out by MATRIX-102 the condition for [oxygen-gas-pressure 1.2Torr and oxygen gas flow rate part / for // and the processing time] 120 seconds. [of 150ml]
[0022] Next, by the same approach as the approach of having formed copper, in order to obtain a flow on the front face of the above-mentioned Bahia hole, after carrying out activation of the front face of a polyimide layer, non-electrolytic copper plating and electrolytic copper plating were performed, and the laminating of the copper foil was carried out on the polyimide layer. The multilayer-interconnection substrate which has the conductor layer of three layers was obtained by etching the copper foil of a front flesh side into coincidence with a predetermined pattern. The obtained multilayer-interconnection substrate did not use adhesives, but was excellent in thermal resistance and dimensional stability, and thin, and flexible.
[0023]
[Effect of the Invention] As mentioned above, according to the manufacture approach of Multilayer FPC of this invention, since manufacture of the non-adhesives type multilayer FPC is possible, it excels in thermal resistance. Moreover, since the thickness of a polyimide insulating layer and a conductor layer is changed by arbitration, a thinner and more flexible flexible printed wiring board can be offered. Furthermore, it becomes a front flesh-side flow is possible and possible not to be based on the number of the Bahia holes in addition to the ability to aim at improvement in the precision by the photolithography method, but to offer easily the multilayer flexible printed wiring board of high density more, since package formation is possible, without forming no through hole by the drilling method.

[Translation done.]

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 05-283865
(43)Date of publication of application : 29.10.1993

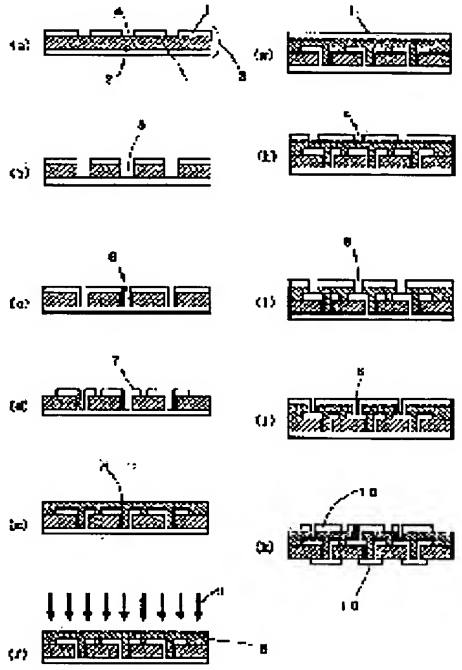
(51)Int.Cl. H05K 3/46
H05K 3/18
// H01R 11/01

(21)Application number : 04-076753
(22)Date of filing : 31.03.1992

(71)Applicant : DAINIPPON PRINTING CO LTD
(72)Inventor : MATSUURA TOMONORI
SAGARA HIDEJI

(54) MANUFACTURE OF MULTILAYER FLEXIBLE PRINTED-CIRCUIT BOARD

(57)Abstract:
PURPOSE: To provide excellent heat resistance, dimensional stability, thinner and flexible by curing polyimide precursor after coating an entire board formed with a circuit pattern to form a polyimide layer, and forming a conductive layer on the surface-treated polyimide layer.
CONSTITUTION: A circuit pattern 7 is formed on a copper foil 1 of a copper-clad board 3 in which polyimide resin is used as a base material 2. The entire board 3 formed with the pattern 7 is coated with polyimide precursor, and cured to form a polyimide layer 8. The layer 8 is surface-treated with oxygen plasma 9, and a conductive layer made of copper is formed by electroless plating and electroplating. A circuit pattern 10 is formed on the conductive layer, and an opening 6 to become a conduction hole 5 with the other layer is formed at the layer 8 by etching. A conductive part is formed in the opening 6 by electroless plating and copper electroplating. The steps after coating of the precursor are repeated to manufacture a circuit board.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号

特開平5－283865

(43)公開日　平成５年(1993)10月29日

(51)Int.Cl.[5]	識別記号	庁内整理番号	Ｆ Ｉ	技術表示箇所
Ｈ０５Ｋ　3/46		Ｎ　6921－4E		
3/18		Ｅ　7511－4E		
3/46		Ｅ　6921－4E		
// Ｈ０１Ｒ　11/01		Ａ　7354－5E		

審査請求　未請求　請求項の数１(全　５　頁)

(21)出願番号　特願平4－76753

(22)出願日　平成４年(1992)３月31日

(71)出願人　000002897
大日本印刷株式会社
東京都新宿区市谷加賀町一丁目１番１号

(72)発明者　松浦　友紀
東京都新宿区市谷加賀町一丁目１番１号
大日本印刷株式会社内

(72)発明者　相楽　秀次
東京都新宿区市谷加賀町一丁目１番１号
大日本印刷株式会社内

(74)代理人　弁理士　米澤．明　(外７名)

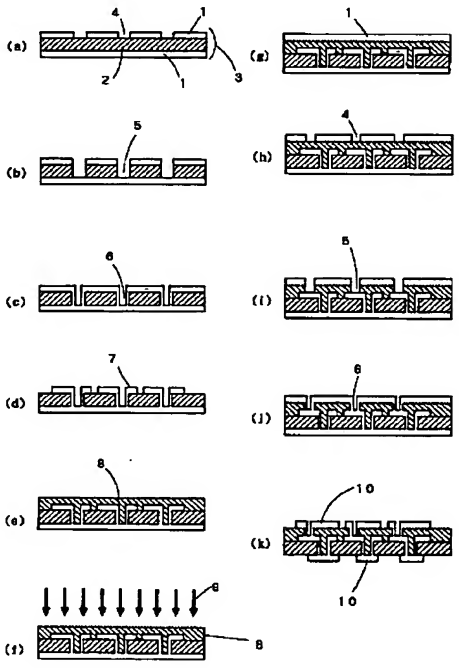
(54)【発明の名称】　多層フレキシブルプリント配線板の製造方法

(57)【要約】

【目的】　耐熱性、寸法安定性に富んだ多層フレキシブル配線基板を得る。

【構成】　ポリイミド樹脂を基材とした銅張基板上の銅箔に回路パターン上に、ポリイミド層を形成した後に、酸素プラズマによってポリイミド層の表面処理した後にポリイミド層上に無電解めっきおよび電気めっきによって導電層を形成した後に、導電層に回路パターンを形成するとともに、ポリイミド層に他層との導通孔となる開口をエッチングによって形成し、開口に無電解めっきおよび電気銅めっきによって導通部を形成する方法であって、ポリイミド前駆体の塗布以降の工程を必要とする多層配線板の層に相当する回数を繰り返すことによって多層フレキシブル配線板を得る。

【効果】　無接着剤による銅箔の積層を可能としたので、信頼性の高い配線板を容易に得ることができる。



1

【特許請求の範囲】

【請求項１】　ポリイミド樹脂を基材とした銅張基板上の銅箔に回路パターンを形成した後に、回路パターンを形成した基板の全面にポリイミド前駆体を塗布の後に硬化処理しポリイミド層を形成した後に、酸素プラズマによってポリイミド層の表面処理し、表面処理したポリイミド層上に無電解めっきおよび電気めっきによって銅からなる導電層を形成した後に、導電層に回路パターンを形成するとともに、ポリイミド層に他層との導通孔となる開口をエッチングによって形成し、開口に無電解めっきおよび電気銅めっきによって導通部を形成する方法であって、ポリイミド前駆体の塗布以降の工程を必要とする層に相当する回数を繰り返すことを特徴とする多層フレキシブル配線板の製造方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、コンピュータや通信機器等の各種電子機器の可動部への配線、ケーブル、コネクター機能を付与した複合部品や、ＬＳＩ実装用の回路モジュール等に使用される多層配線板、特に多層フレキシブルプリント配線板に関するものである。

【０００２】

【従来の技術】フレキシブルプリント配線板は、屈曲可能な薄いベースフィルム上に金属配線を施したもので、実装スペースの節約や信頼性の向上に役立ち、コンピュータ関連機器、オーディオ製品、通信機器等に広く利用されている。近年の電子機器の小型化、軽量化、薄型化、高密度化に伴い、フレキシブルプリント配線板にもリジッドプリント配線板と同様に多層化の要求が高まっている。プリント配線板の多層化は、表裏は勿論内部にも幾層ものプリント配線を有しているため、ＩＣ、ＬＳＩ、超ＬＳＩ等の集積回路との併用により、電子回路の部品間距離の短縮、部品数と接続部分の大幅な削除を可能にした。

【０００３】多層フレキシブルプリント配線板は従来からいろいろな製造方法によって実施されているが、金属の導電層を３層有する３層フレキシブルプリント配線板を例に挙げ、製造工程の一例を図３に示す。

【０００４】まず図３（ａ）に示すように、銅箔３１をポリイミド等の絶縁層を基材３２とする両面銅張基板の、他の層を積層後に内層となる回路パターン３３をフォトエッチング法等により形成し、内層と外層とを導通するために孔を形成した後、ポリイミド樹脂の表面を活性化処理の後に無電解銅めっきを行い、次いで電気銅めっき行って導通孔３４を形成する。そして、図３（ｂ）に示すように、両面銅張基板の一方に形成した回路パターンとポリイミド等の絶縁層を基材とする片面銅張基板３５の絶縁層３６側とを、エポキシあるいはアクリル系の樹脂を含浸したガラス繊維布等からなるプリプレグ３７を介して積層し、図３（ｃ）に示すように、ヒートプレス３８によって加熱下で加圧して硬化する。次に、図３（ｄ）に示すように、表裏導体層と内部導体層との導通を形成するスルー孔３９を設け活性化処理の後、無電解銅めっきおよび電気銅めっきを行い、さらに図３（ｅ）に示すように、フォトエッチング法により表裏の銅箔３１に回路パターン形成している。

2

【０００５】

【発明が解決しようとする課題】ところが、このような方法では、積層時に用いるプリプレグがエポキシあるいはアクリル系の材料を使用しているため、耐熱性、寸法安定性に問題を生じる。また、ポリイミド等の絶縁層を基材とする銅張基板が絶縁層の厚さ３５～５０μｍ、導体である銅箔の厚さが１８～３５μｍであるため、この銅張基板を用いて積層すると積層後の基板総厚が厚くなり、薄型化に反するばかりかフレキシブルプリント配線板の特徴である可撓性が低下しかねない。また、スルー孔により表裏導体層と内部導体層との導通を形成しているため、屈曲時に発生するスルーホール部への応力集中により内壁部が断線し易くなってしまう。さらに積層アライメント精度確保のために表裏及び内層のランド径が大きくなり、表裏及び内層の導体の配線が制限され高密度配線が困難となるとともに、設計面でも制限が大きくなる。

【０００６】本発明は、上記課題を解決すべくなされたものであり、耐熱性、寸法安定性に優れ、より薄く、よりフレキシブルで物理的応力が緩和され、さらに高密度配線を可能にした多層フレキシブルプリント配線板の製造方法を提供することを目的とする。

【０００７】

【課題を解決するための手段】本発明は、ポリイミド樹脂を基材とした銅張基板上の銅箔に回路パターンを形成した後に、回路パターンを形成した基板の全面にポリイミド前駆体を塗布し硬化処理しポリイミド層を形成した後に、酸素プラズマによってポリイミド層の表面処理した後に、表面処理したポリイミド層上に無電解めっきおよび電気めっきによって銅からなる導電層を形成した後に、導電層に回路パターンを形成するとともに、ポリイミド層に他層との導通孔となる開口をエッチングによって形成し、開口に無電解めっきおよび電気銅めっきによって導通部を形成する方法であって、ポリイミド前駆体の塗布以降の工程を必要とする多層配線板の層に相当する回数を繰り返すフレキシブル配線板の製造方法である。

【０００８】すなわち、本発明はポリイミド樹脂を基材とした両面銅張基板を用い、（ａ）前記両面銅張基板の銅箔面に所定の開口部を設ける工程と、（ｂ）前記開口部より露出したポリイミド樹脂部のみを選択的に除去する工程と、（ｃ）前記ポリイミド樹脂部が選択除去された部位にて表裏銅箔間の導通を行う目的で活性化の後、無電解銅めっき及び電気銅めっきを行う工程と、（ｅ）

前記所定回路の形成がなされた両面銅張基板の回路形成面に、溶剤含有ポリイミド系ペーストを塗布し、ポリイミド系ペーストが塗布された両面銅張基板を熱処理してポリイミド系ペーストの硬化を促進する工程と、（ｆ）ポリイミド系ペーストを熱硬化処理して形成されたポリイミド絶縁膜の表面を酸素プラズマ処理によって表面処理する工程と、（ｇ）前記表面処理されたポリイミド絶縁膜を活性化処理した後、無電解めっきおよび電気銅めっきを行い金属箔の形成を行う工程と、（ｈ）前記金属銅箔の所定部に開口部を設ける工程と、（ｉ）前記開口部より露出したポリイミド絶縁膜を選択的に除去する工程と、（ｊ）前記ポリイミドが選択的に除去された開口部を通じて、前記第１の所定回路部と金属銅箔との導通を行う目的で、活性化処理した後に、無電解銅めっき及び電解銅めっき処理を施す工程と、（ｋ）前記銅めっきにて形成された金属銅箔面に第２の所定回路の形成を行う工程により多層化を可能とし上記課題を達成したものである。

【０００９】

【作用】本発明の製造方法により、耐熱性、寸法安定性に優れ、より薄く、よりフレキシブルで物理的応力が緩和され、高密度配線が可能な信頼性の高い多層ＦＰＣを提供することができる。

【００１０】

【実施例】以下、図面をもとにして本発明の実施例を説明する。図１は、本発明における多層フレキシブルプリント配線板である３層フレキシブルプリント配線板の製造工程を示したものである。

【００１１】図１（ａ）に示すように銅箔１をポリイミドの基材フイルム２の両面に積層した銅積層基板３の一方の銅箔に、内層の電気回路となる銅箔と表層の銅箔とを導通するためのバイア孔を設けるために、バイア孔用に銅箔に孔４をエッチングによって形成する。図１（ｂ）のように、銅箔をマスクとして、基材フイルム２に、バイア孔用の孔５を形成する。エッチング液には、水酸化カリウムなどのアルカリ金属水酸化物を含有したアルコール溶液を用いることができる。図１（ｃ）に示すように、内層導体と裏層導体とを導通させるために、塩化パラジウム、塩化第１錫等によって基材フイルムの表面の活性化を行った後に、無電解めっきを行い、次いで無電解めっきで得られた銅の薄膜上に銅を電気めっきして、バイア孔６を完成させる。図１（ｄ）に示すように、内層用の導電層上に所定の回路パターン７をエッチングによって形成し、図１（ｅ）に示すように、所定の回路を形成した基板上に、加熱によってポリイミドフイルムが得られるポリイミド系被覆剤等のポリアミド酸等からなる被覆剤を塗布した後に、溶剤を加熱して除去した後に、さらに加熱を行って硬化処理してポリイミド層８を形成した。

【００１２】図１（ｆ）に示すように、酸素プラズマ９

によってポリイミド層の表面を処理し、ポリイミド層上への銅の付着力を高めた。図１（ｇ）に示すように、ポリイミド層７の表面を活性化した後に銅の無電解めっきを行い、得られた銅の薄膜上に電気めっきによって銅箔を形成した。

【００１３】図１（ｈ）に示す用に、銅箔１上に、図１（ａ）に示す方法と同様の方法で、多層間のバイア孔に相当する孔４を形成し、図１（ｉ）に示すように、図１（ｂ）に示す方法と同様に、図１（ｈ）の工程で得られた孔を形成した銅箔をマスクにしてポリイミド層７に孔５を形成した。さらに、図１（ｊ）に示すように、図１（ｃ）に示す方法と同様に、多層間の導通を形成するバイア孔６を形成した。そして、図１（ｋ）に示すように、両面の銅箔をエッチングして回路パターン１０を形成した。

【００１４】以上の工程によりブリブレグを用いた方法のように、接着層を用いることなく、耐熱性、寸法安定性に優れたより薄く、よりフレキシブルな、高密度配線可能な多層フレキシブルプリント配線板ＦＰＣを製造することができる。

【００１５】また、図１（ｊ）に示す工程の後に、図１（ｄ）～図１（ｊ）と同様の工程を繰り返すことによって３層以上の多層配線基板を製造することができる。図２には、全部で６層の導電層を有する多層配線基板の一例を示す。

【００１６】ポリイミドフイルム２２上には、導電層２２ａが形成されており、導電層２２ａ上には、ポリイミド層２３ａが設けられており、さらにポリイミド層上には、導電層２２ｂ、ポリイミド層２３ｂ、導電層２２ｃ、ポリイミド層２３ｃ、導電層２２ｄ、ポリイミド２３ｄが設けられている。

【００１７】そして、多層基板の両面には回路パターン２４が形成されており、各導電層間を導通させるバイア孔２５が形成されている。

【００１８】実施例１

両面に厚さ１８μｍの銅箔を積層したポリイミド絶縁層の厚さ３５μｍ銅箔積層ポリイミドフイルム（新日鉄化学（株）製、商品名：エスパネックス両面板）の片面に、内層となる導体回路と表層となる導体回路とを導通するためのバイア孔を設けるため、銅箔にバイア孔用の直径３００μｍの孔をフォトエッチング法により形成した。エッチングは、４２° Ｂｅの濃度の塩化第２鉄水溶液をエッチング剤として温度４０℃、スプレー圧１．０ｋｇｆ／ｃｍ² のスプレーエッチングによって行った。

【００１９】ついで、孔を形成した銅箔をマスクとして、１Ｎの水酸化カリウムのエタノールと水とを８：２の割合で混合したアルコール溶液をエッチング剤として、温度７０℃において、超音波の照射下においてバイアホール形成部分のポリイミド樹脂層を選択的にエッチング除去した。

5

【００２０】次に、バイア孔内部に導電層の形成を行った。まず、塩化パラジウム（$PdCl_2$）：０．２ｇ／ｌ、塩化第１錫（$SnCl_2 \cdot 2H_2O$）：２０ｇ／ｌ、塩酸（ＨＣｌ，３５％）：２００ｍｌ／ｌを純水で全体を１０００ｍｌとした液温度：４０℃の活性化液に、浸漬時間：２分浸漬し、ポリイミド樹脂の表面を活性化し、硫酸銅（$CuSO_4 \cdot 5H_2O$）：５ｇ／ｌ、ロッセル塩（$KNaC_4H_4O_6$）：２５ｇ／ｌ、ホルマリン（ＨＣＨＯ）：１０ｍｌ／ｌ、水酸化ナトリウム（ＮａＯＨ）：７ｇ／ｌ、純水で全体を１０００ｍｌとした液を使用して、液温度：２０℃で無電解めっきを行った。続いて、硫酸銅（$CuSO_4 \cdot 5H_2O$）：２４０ｇ／ｌ、硫酸（H_2SO_4，比重１．８３）：５０ｇ／ｌ、陰極電流密度：３Ａ／ｄｍ²、陰極：陽極＝１：１、陽極：電気銅、浴電圧：３Ｖ、液温度：３０℃の条件で銅を電気めっきした。

【００２１】ついで、４２°Ｂｅの塩化第２鉄水溶液をエッチング液として、温度４０℃、スプレー圧１．０ｋｇ／ｃｍ²のスプレーエッチングにより、内層となる銅箔に所定の回路を形成した後、内層の導体を形成した側に、ポリイミド前駆体（新日鉄化学（株）製商品名、ポリイミドベーストＳＰＩ－２００Ｎ）を、１５０メッシュの版を用いてスクリーン印刷法により２４μｍの均一な厚さに塗布し絶縁層を形成した。その後、コンベア式の遠赤外線炉で１３０℃、１０分間加熱して溶剤成分であるＮＭＰ（Ｎ－メチル－２－ピロリドン）を蒸発させ、２７０℃、２分間の加熱によってポリイミドベーストを完全に硬化させてポリイミド層を形成した。得られたポリイミド層の表面を、酸素プラズマによって表面処理した。酸素プラズマによる処理は、ドライテック社製ＭＡＴＲＩＸ－１０２で酸素ガス圧１．２Ｔｏｒｒ、酸素ガス流量１５０ｍｌ／分、処理時間１２０秒間の条件で行った。

【００２２】次に、上記したバイア孔の表面に導通を得るために銅を形成した方法と同一の方法によって、ポリイミド層の表面を活性化処理した後に、無電解銅めっき＊

6

＊と電気銅めっきを行ってポリイミド層上に銅箔を積層した。表裏の銅箔を所定のパターンによって同時にエッチングすることによって３層の導体層を有する多層配線基板を得た。得られた多層配線基板は接着剤を使用しておらず、耐熱性、寸法安定性に優れ、薄く、またフレキシブルであった。

【００２３】

【発明の効果】以上のように本発明の多層ＦＰＣの製造方法によれば、無接着剤タイプの多層ＦＰＣの製造が可能であるため耐熱性に優れる。また、ポリイミド絶縁層、導体層の厚さを任意に変えられるため、より薄く、よりフレキシブルなフレキシブルプリント配線板を提供することができる。さらに、ドリル加工法によるスルーホールをいっさい形成せずに表裏導通が可能であり、フォトリソグラフィー法による精度の向上が図れることに加え、バイア孔数によらず一括形成が可能であるため、より高密度の多層フレキシブルプリント配線板を容易に提供することが可能となる。

【図面の簡単な説明】

【図１】本発明の多層フレキシブル配線板の製造方法の一実施例を説明する図。

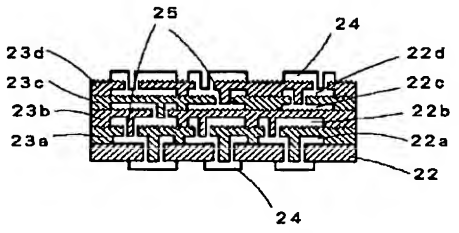
【図２】本発明の方法によって製造した導電層が６層の多層フレキシブル配線板の一実施例を説明する図。

【図３】従来の多層ＦＰＣの製造方法を説明する図。

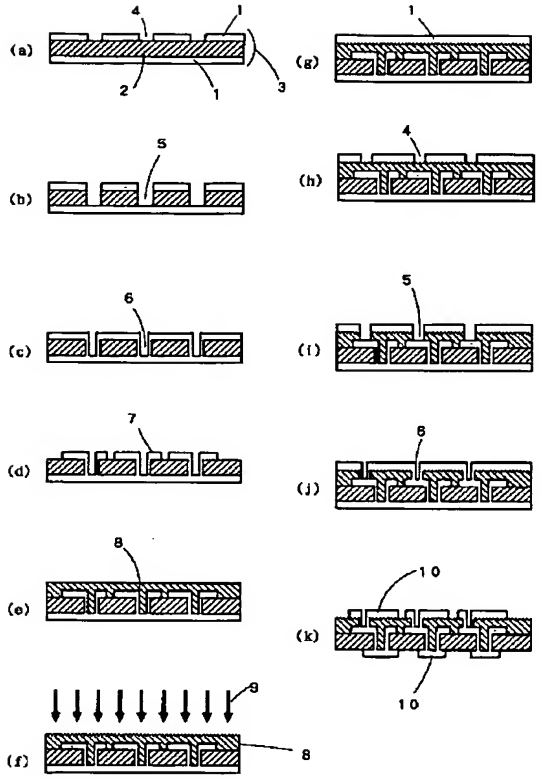
【符号の説明】

１…銅箔、２…基材フイルム、３…銅積層基板、４…孔（銅箔）、５…孔（基材フイルム）、６…バイア孔、７…回路パターン、８…ポリイミド層、９…酸素プラズマ、１０…回路パターン、２１…ポリイミドフイルム、２２ａ、２２ｂ、２２ｃ、２２ｄ…導電層、２３ａ、２３ｂ、２３ｃ、２３ｄ…ポリイミド層、２４…回路パターン、２５…バイア孔、３１…銅箔、３２…基材、３３…回路パターン、３４…導通孔、３５…片面銅張基板、３６…絶縁層、３７…プリプレグ、３８…ヒートプレス、３９…スルー孔

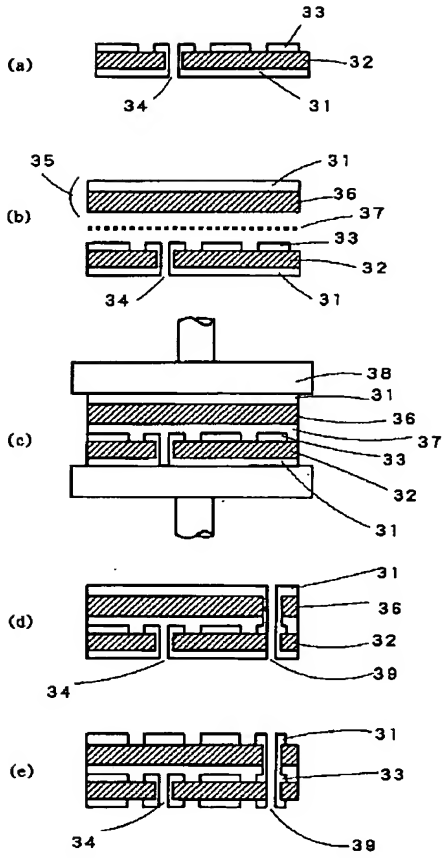
【図２】



【図１】



【図３】



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] After forming a circuit pattern in the copper foil on the copper-clad substrate which used polyimide resin as the base material After applying a polyimide precursor, carrying out hardening processing and forming a polyimide layer in the whole surface of the substrate in which the circuit pattern was formed After a polyimide layer's carrying out surface treatment by the oxygen plasma and forming the conductive layer which consists of copper by nonelectrolytic plating and electroplating on the polyimide layer which carried out surface treatment, while forming a circuit pattern in a conductive layer Opening used as a flow hole with other layers is formed in a polyimide layer by etching. The manufacture approach of the multilayer flexible patchboard characterized by repeating the count equivalent to the layer which is the approach of forming the flow section and needs the process after spreading of a polyimide precursor for opening with nonelectrolytic plating and electrolytic copper plating.

[Translation done.]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]